WoodWisdom-Net

MouldPulp

# MouldPulp

# Development of Durable, Fully Bio-Based Thermoplastic Composites from Bioplastics and Pulp Fibres for Injection Moulding Applications

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# Project Objectives and Main Tasks

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## Background

- Promising wood-polymer concept DuraPulp® from cellulose pulp and PLA
- Fully bio-based
- Good mechanical properties
- Perceived naturalness and nice tactile properties
- Dyeing with clear colours possible

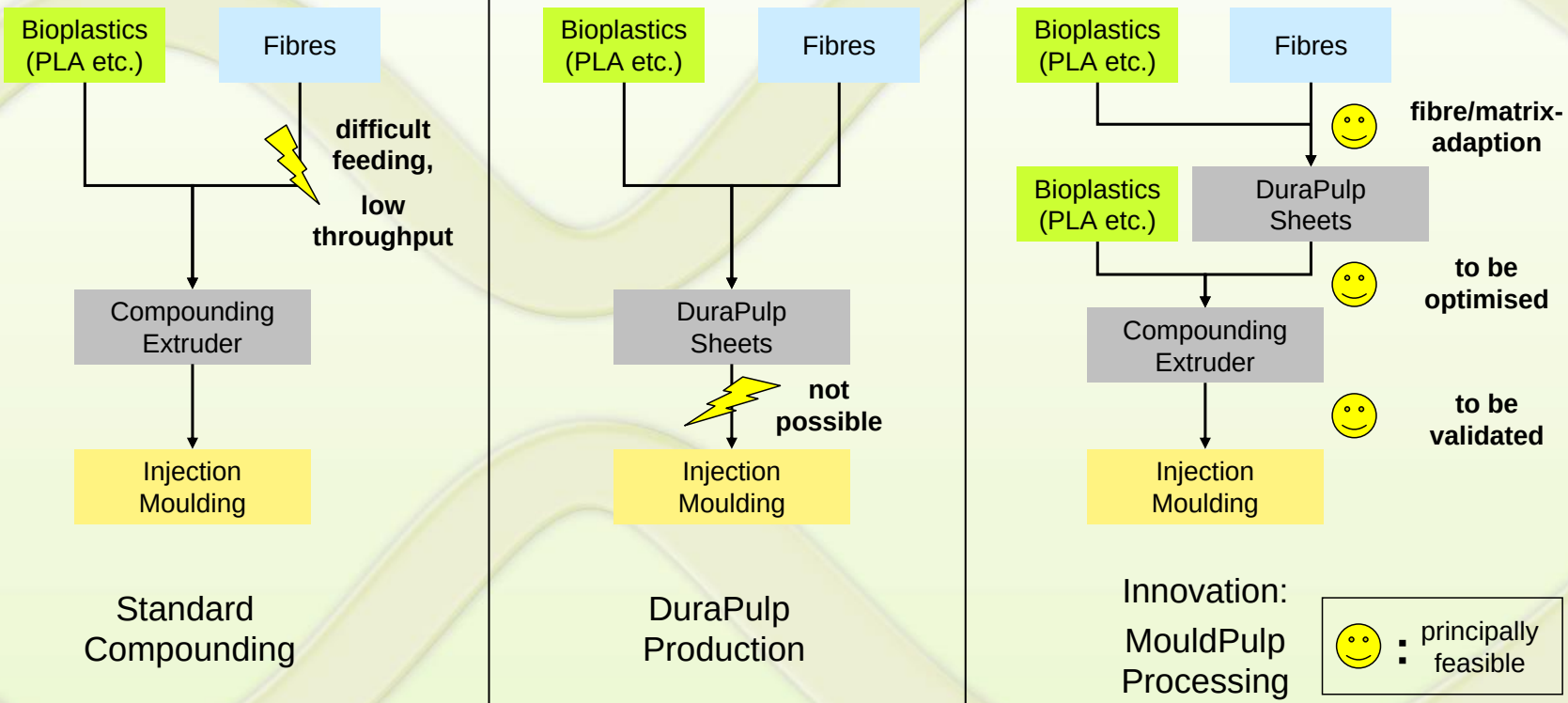
## Problem

- Lack of viable industrially production methods to make end consumer products

## Objective

- Development of a processing technology that allows to make injection moulded parts out of DuraPulp® but keeping the material identity

# Project Objectives and Main Tasks



# Expected Impact and Target Groups

**Novel natural fibre reinforced composite DuraPulp®**

- 100% bio-based composite (PLA & pulp)
- Injection moulding

**Significantly increasing of using natural fibre reinforced biopolymers**

**Open up the market of consumer products**

- High efficient processing technology (IM)
- Durable, high-quality products
- Light-weight, naturally impression, dyeable
- Good eco-balance

# Expected Impact and Target Groups

**Innovative bio-based consumer products for a worldwide market made in Europe**

- Use of cellulose pulp strengths the forest-based value chain
- Novel and modified processing technology creates new opportunities for machine manufacturers
- Novel design concepts for consumer products
- Generation of manufacturing capacities

**In accordance to the European Lead Market Initiative focused on bio-based products**

# Added Value from Transnational Approach

**Multidisciplinary and international approach is required to reach the project goals:**

- Preparation of functionalized fibres (Innventia, Södra)
- Development of bioplastics (Fraunhofer UMSICHT)
- Plastics processing (FKuR, Hammarplast, Elastopoli)
- Techno-economic and environmental assessment (nova, Innventia)

**Trans-European approach due to long-termed regional knowledge build-up:**

- Sweden: Wood and pulp processing
- Germany: Bioplastics production and promotion
- Finland: Fibre reinforced plastics

**In addition the transnational approach will help to disseminate the project results and to transfer the technology into the industry.**

# Project Partners and their Roles

## Project team along the whole value chain

R&D Assessment Materials Manufacturing Market

**Fraunhofer UMSICHT**
(Germany)
Material development bioplastics

**Innventia AB**
(Sweden)
Material development pulp
Developer of DuraPulp

**Södra**
(Sweden)
Raw materials &
product development

**Hammarplast Consumer AB**
(Sweden)
Consumer plastics products

**FKuR Kunststoff GmbH**
(Germany)
Compounding company for bioplastics

**nova-Institut GmbH**
(Germany)
Techno-economic and
ecological assessment

**Elastopoli Oy**
(Finland)
Application development

# Project Partners and their Roles

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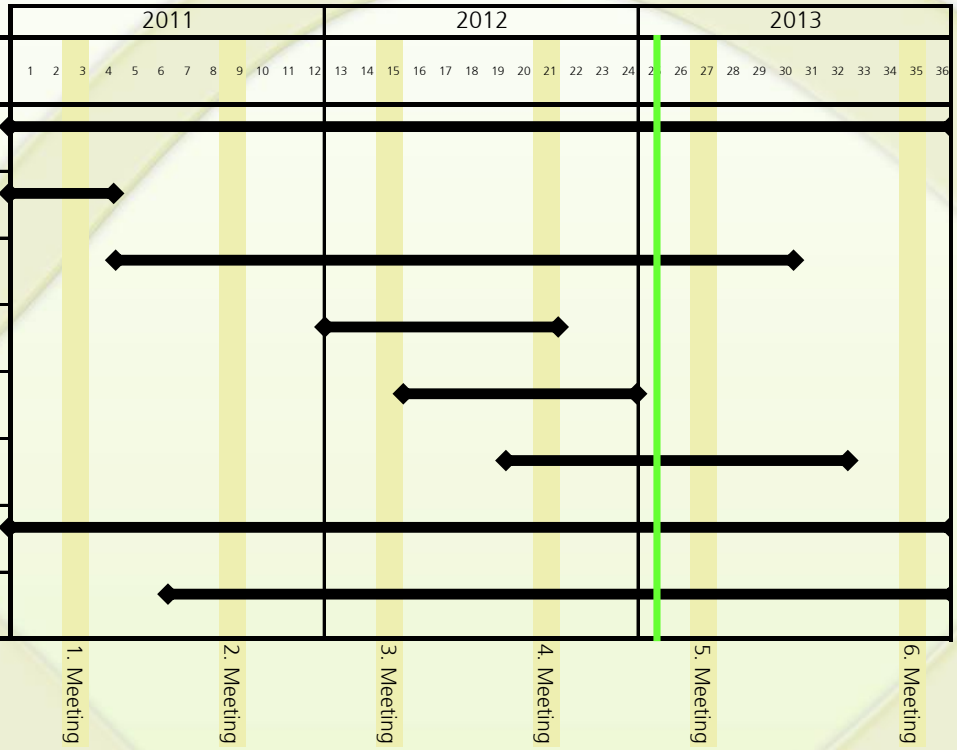
## Work packages and time table

| Nr. | Work Package | Responsible |
|---|---|---|
| WP0 | Project management | UMSICHT |
| WP1 | Definition of specifications | Elastopoli |
| WP2 | Fibre-matrix adaption | Södra |
| WP3 | Development of compounding process | UMSICHT |
| WP4 | Application tests, micro-mechanics, recycling | Innventia |
| WP5 | Scale-up and industrial validation | FKuR |
| WP6 | Techno-economic and ecological assessment | nova |
| WP7 | Dissemination | nova |



# Project Highlights

**WP1: Definition of specifications (final results 2011)**

**WP2: Fibre-matrix adaption (intermediate results)**

**Different fibre types were tested with regard to**

- fibre-matrix adaption,
- yellowish discoloration.

**Pulp fibres and polymer were coloured with pigment colours (red and blue).**

- Colouring was successful.
- Colouring of fibres is expensive.
- Injection moulded parts with uncoloured fibres are looking very good.
- Colouring of fibres is not further considered.

Coloured pulp fibres

# Project Highlights

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**WP3: Development of compounding process**

**Conducted issues and tasks**

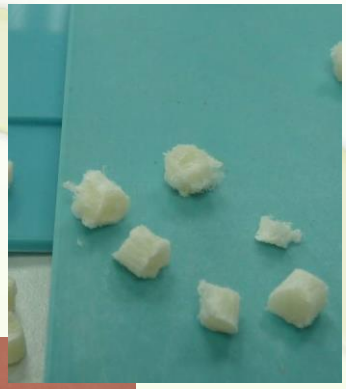
- Preselection of PLA injection moulding grades
- Investigation of the influence of lignin content on yellowish discoloration
- Investigation on different additives:
  - Impact modifiers
  - Coupling agents
  - Bleaching agents
- Optimizing the process steps from bulk to injection moulding
- Compounding and injection moulding trials
- Material testing

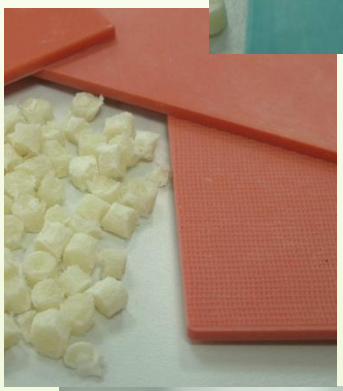
Impact tests

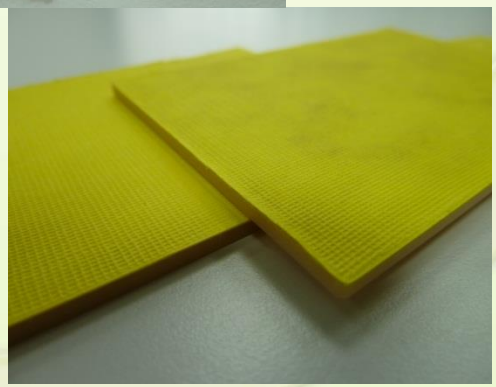
# Project Highlights

## WP3: Development of compounding process (final results)

- Fibre contents up to 30 % were achieved.
- The mechanical properties of the compounded material were as expected comparable to other natural fibre reinforced PLA grades.
- The potentials of the MouldPulp material are lying in the natural visual and haptic impression.
- Test specimens with different surfaces for visual and haptic tests were provided to measure the value test persons are given to MouldPulp against conventional plastics,
- The colouring of the compounded material during injection moulding (dry blend) was possible with conventional masterbatches.
- In-Mould-Labelling of the material is also possible.







# Project Highlights

**WP4: Application tests, micro-mechanics, recycling (intermediate results)**

- Naturalness and quality of the demonstrators should be evaluated and compared to PP samples by panels of observers.
- Literature study on PLA recycling.

**WP5: Scale-up and industrial validation (intermediate results)**

**Pre-treatment of Durapulp**

- Best results are achieved if pulp is pelletized prior to compounding.
- Trials at different experts for pelletizing have been carried out without satisfying results.
- Dosing problem has still to be solved!

# Project Highlights

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**WP6: Techno-economic and ecological assessment (intermediate results)**

## Market Survey

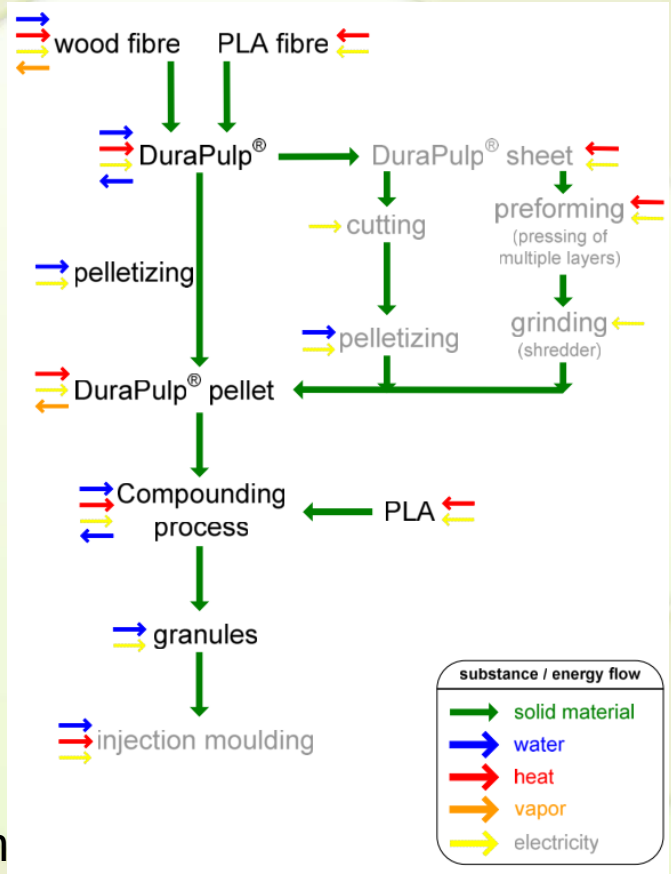
- The evaluation has provided additional information, among others, on mechanical properties, dyeing properties, price ranges and fields of application.

## SWOT-Analyses

- SWOT displays a secure bio-based feedstock supply as strength and the charpy impact as weakness.

## Production costs

- Further information could be gathered in regard to the assessment of investment and production costs.



# Project Highlights


## Summary and Outlook

- 3rd meeting in March 2012
  4th meeting in September 2012
  First samples of developed material
- Market survey:
  Questionaire at 5th International Conference on Bioplastics and Composites, further evalutations at "Composites Europe" fair and at the "Designers' Open", online survey at "Green Premium"

- Dissemination: Homepage www.mouldpulp.com, further exhibitions, presentations
- WP1 “Specifications” is finished
- WP3 “Development of compounding process” is finished:
  Material has expected properties and shows natural impressions
- End of WP4 “Application tests” postponed 3 month but without implication to the project goals
- MouldPulp is in time and will achieve the project objectives

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**Thank you for your attention.**